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Proposed Action Memorandum
Trench T3 (IHSS 110)
NAPL Extraction

March 1995

Draft

Proposed Action Memorandum Trench 3 (IHSS 110) NAPL Extraction

Rocky Flats Environmental Technology Site (OU2)

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Draft

Proposed Action Memorandum Trench 3 (IHSS 110) NAPL Extraction

Rocky Flats Environmental Technology Site (OU2)

U.S. DEPARTMENT OF ENERGY
The Rocky Flats Environmental Technology Site
Golden, Colorado

ENVIRONMENTAL RESTORATION PROGRAM DIVISION

MARCH 1995

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1.0 PURPOSE

The purpose of this action is to remove, by pumping, the available organic phase liquid found in Borehole 25194, located in Trench 3 of OU2 (See Figure 1 in Appendix A). The extraction of these liquids, (while not numerically quantifiable), will reduce the risk of migration of the contaminants from the source area. After extraction, the organic phase liquids will be temporarily stored in a permitted storage unit until transferred off site for disposal. This action is consistent with the Environmental Protection Agency (EPA) Office of Solid Waste and Emergency Response (OSWER) Directive No. 9283.1-69 entitled: "Considerations in Groundwater Remediation at Superfund Sites and RCRA Facilities – Update," dated May 27, 1992. The OSWER directive expands EPA's policy concerning non-aqueous phase liquid contaminants. In Section B.2, it states that ". . . NAPL should generally be removed from the subsurface as an early action . . .".

2.0 PROJECT DESCRIPTION

2.1 BACKGROUND AND DATA SUMMARY

Operable Unit Number 2 (OU2) Trench 3 Individual Hazardous Substance Site (IHSS) 110 (See Figure 1 in Appendix A) was reportedly used to dispose sanitary sewage sludge contaminated with uranium (U) and plutonium (Pu), and flattened drums contaminated with uranium from 1954 to 1968. The dimensions of Trench 3 range approximately 5 to 10 feet in depth, 19 to 23 feet wide, and 135 to 140 feet long. Data also shows that Trench 3 contains oil, fuels, and solvents.

The uppermost geologic unit in the vicinity of Trench 3 is Rocky Flats Alluvium (RFA), an alluvial fan deposit which extends approximately 15-feet beneath the trench. RFA is underlain by the Arapaho Formation, which consists of claystone beneath the west-end of Trench 3 and sandstone (No. 1 Sandstone) beneath the east-end. The Arapaho Formation No. 1 Sandstone ranges in thickness from approximately 20 to 35 feet (See Figure 2 in Appendix A).

The upper hydrostratigraphic unit (UHSU) in the vicinity of Trench 3 area consists of saturated portions of RFA and/or the Arapaho Formation No. 1 Sandstone. Depth to UHSU groundwater beneath Trench 3 varies between 22 to 30 feet below ground surface . The groundwater flow direction in RFA in Trench 3 is primarily to the northeast along the medial paleoscour. The groundwater flow direction in the No. 1 Sandstone of Trench 3 is primarily to the north.

The subsurface soil analytical data and soil gas data collected from Trench 3 indicated the trench is a source of volatile organic compound (VOC) contamination (1, 1, 1-trichloroethane (TCA), 1,2-dichloroethane (DCA), carbontetrachloride (CCl_4), chloroform ($CHCl_3$), tetrachloroethylene (PCE), and trichloroethylene (TCE)) to the subsurface soil. Trench 3 appears to be a source of CCl_4, $CHCl_3$, PCE, and TCE to the groundwater.

These VOCs are observed primarily in the No. 1 Sandstone flow system north of Trench 3. The concentrations of VOCs in subsurface soils decrease with depth. The soil gas survey data collected in Trench 3 indicated that a CCl_4 soil gas plume is located in the west-end of the trench. PCE and TCE soil gas plumes are located in the west central part of the trench. Low concentrations of Aroclor-1254 (6900 ug/kg) were observed in samples collected from within Trench 3. The detection of PCB's is important, because it may impact the disposal of organic phase liquids

extracted from the trench. Also, elevated activities of americium (Am-241), Pu-239/240, U-233/-234, &-235, and U-238 were observed in the samples collected from within Trench 3.

During the preliminary investigation of Trench 3, non-aqueous phase liquid (NAPL) was observed in the subsurface materials. A yellowish-brown liquid consisting of one or more free-phase chlorinated hydrocarbons (CHCs) was observed during this investigation in borehole 10191 at an approximate depth of 2.8 feet. In November and December of 1994, samples were collected from locations 25194, 25294, 25394, 25494, 25594, and 25694 (see Appendix A, Figure 3). An empty void space was encountered at bore hole location 25494. This void space exists from 4.0 to 6.5 feet below ground surface. Liquid samples collected from this location in November and December, 1994 contained gasoline, diesel, TCE, PCE and radionuclides. The analytical results of these sampling events are in Appendix B.

As is evident from the analytical data, the major components of the NAPL are gasoline and diesel. Although the NAPL contains other contaminants, as previously described, the gasoline and diesel will be the primary focus of the NAPL extraction from the void space at location 25494.

The NAPL was not extracted when initially encountered because the Interagency Agreement between the Department of Energy, the Colorado Department of Public Health and Environment and the Environmental Protection Agency only allows for three types of removal actions. These actions include Emergency Actions, Proposed Action Memorandums (PAMs) and Interim Measures/Interim Remedial Actions (IM/IRAs). The only action that is applicable for the extraction of the NAPL is the PAM, since emergency actions are for recent spills and an IM/IRA is intended for more complex actions.

2.2 CONTAMINANT MIGRATION

The physical barrier which has retained this oil and water in a perched condition is not well understood. There is a potential that almost any action could mobilize the contaminants. In the specific case of pumping, there is a potential to mobilize contaminants due to subsidence, extraction of the barrier, sloughing and migration due to soil retention capacity related to changes in the water surface. For these reasons, the intent of this action is to extract primarily the oil phase liquid.

To reduce the potential to cause contaminant migration to other parts of the trench and/or below, the action will be considered complete when any of the following conditions are met:

- It is estimated that 1 – 2 drums of NAPL's will be extracted during this action. Although the total volume of NAPL's to be extracted will be limited to 10 drums.
- If the pumped liquids at any given time contain more than 25 percent water, the pump elevation will be adjusted to primarily pump the oil phase liquids. If greater than 25 percent water is still being removed the action will be complete.
- Any noticable surface subsidence is noted.
- A sudden change in turbidity of the pumped liquid is observed, which may indicate sloughing of the void side walls.
- The elevation of the water/oil interface drops more than 1 foot.
- The gross volume of pumped liquid contains more than 10 percent water.

2.3 PROCEDURE

The following procedure steps will be used to accomplish the extraction action:

1) Prepare documentation, including a Health and Safety Plan.
2) Obtain and mobilize all required equipment and supplies (i.e., bladder pump, gas cylinders, personal protective equipment (PPE), drums, and probes).
3) Using an organic interface probe, determine the elevation of the oil/water interface in the well.
4) Set the pump in the well with the intake approximately 1 inch above the water surface (Note: The pump intake will have a 1/32-inch screen to exclude granular media). A bailer may be used to remove the organic phase liquids in the event the pump is unable to extract the liquids (i.e. because the liquids are too viscous).
5) Begin pumping with the bladder pump, set to discharge at approximately .5 gpm.
6) At .5 barrel intervals, stop pumping and determine the elevation of the oil/ water interface in the well and the fluid levels in the receiving drums.
7) Determine if pumping is to continue based on the action completion criteria, and if so, adjust the pump elevation and continue. If the collected material fills less than one drum, then wait approximately 12 hours and repeat this procedure starting at Step 3 (this repetition of procedure will be limited to one event).

8) At the conclusion of the pumping action, remove and decontaminate the pump and equipment.

9) Recap the well.

10) Sample and seal the drums, and take drums to the appropriate storage area.

11) Field extraction phase complete.

12) Determine final disposition and dispose of waste.

13) Accelerated action is complete.

3.0 WASTE MANAGEMENT CONSIDERATION

After extraction of the available organic-phase liquids from the Trench 3, the liquids will be placed into steel drums and will be managed in accordance with the Resource Conservation and Recovery Act/Colorado Hazardous Waste Act (RCRA/CHWA) and Department of Energy (DOE) requirements. Drums containing liquid waste will be placed into storage on the day of generation in accordance with DOE Order 5820.2A and waste storage/management criteria. The maximum volume of removed liquids is estimated to be approximately 500 gallons and fill as many as 10 drums. This volume is based on the maximum size of the void space that could be present without collapsing and professional judgment. It is estimated that this action will yield a total volume of 1 – 2 drums.

The extracted organic-phase liquid waste will be stored at Rocky Flats Environmental Technology Site (RFETS) in RCRA Unit 1 while awaiting disposal. Although not part of this action, the organic phase waste will be sent to Diversified Scientific Services, Inc. (DSSI) for disposal in their permitted incinerator. DOE has a contract with DSSI for the disposal of low-level mixed solvent waste generated at RFETS. The disposal firm does require the media be screened with a 1/32-inch screen before shipment and the water content of the waste must be <10 percent and contain <50 ppm of polychlorinated biphenyls (PCBs). The screening requirement is to prevent solids from clogging DSSI's injection system. This activity will be conducted in the field by placing a 1/32-inch screen on the intake of the pumping mechanism. This will also prevent the generation of waste that RFETS cannot dispose of at DSSI.

During the waste generation activities, samples will be collected for characterization and waste disposal requirements. The sampling and analytical methods will be in accordance with the waste acceptance criteria (WAC) for DSSI, or other disposal sites if it becomes apparent the waste cannot meet the DSSI acceptance criteria.

The extraction of the organic-phase liquid waste is a reliable long-term option and maintenance is not required. Extraction of NAPLs can also be implemented easily and quickly. Special permits will not be required, and mixed waste storage capacity is available at RFETS for the removed liquid waste prior to disposal.

4.0 NEPA CONSIDERATIONS

The National Environmental Policy Act (NEPA) requires that actions at RFETS be evaluated for potential impacts to the environment. Impacts to the natural environment resulting from the removal action would be minimal and include in some downed vegetation in the immediate vicinity of the well site; however, there are not expected to be any adverse impacts to wetlands, floodplains, threatened or endangered species or their habitats, and historic or cultural resources. There would be minor releases of air pollutants from the pump motor and a very minor increase in particulates (dust) associated with the operation of trucks loading and unloading drums. The potential exists for radionuclide and chemical exposure to the worker and the environment during pumping, recapping, transportation, and decontamination activities, but their potential is expected to be mitigated by workers wearing appropriate protective equipment and by following relevant procedures.

5.0 CONSISTENCY WITH LONG TERM OBJECTIVES

The four alternatives being evaluated for the source remediation of Trench 3 require removal of liquids by pumping or volatilization to be effective. Therefore, removal of NAPLs in Trench 3 is consistent with long-term remedial action objectives.

6.0 SCHEDULE

The following is a proposed schedule for implementation of this action:

- March 1, 1995 — Draft Proposed Action Memorandum (PAM) to Agencies
- March 20, 1995 — Issue PAM to Public, EPA, and the Colorado Department of Public Health and Environment (CDPHE)
- April 18, 1995 — End Public Comment Period
- May 2, 1995 — PAM Final Draft
- May 17, 1995 — Approval of PAM by EPA and CDPHE
- June 16, 1995 — Documentation and Contractor Procurement Complete
- June 28-30, 1995 — Extraction Complete
- November 8, 1995 — Waste Acceptance Criteria Met
- November 21, 1995 — Ship Waste for Disposal

7.0 ARARs

In accordance with the Interagency Agreement (IAG), an objective of accelerated actions at RFETS is the identification and compliance with Federal and State ARARs that are associated with this proposed action. ARARs for remediation levels are not applicable to this action. However, ARARs relating to the action will be addressed in this section.

There are three types of ARARs: (1) chemical-specific, (2) location-specific, and (3) action-specific. Chemical-specific ARARs set health-based or risk-based concentration limits for soil, groundwater, or surface water for specific pollutants. There are no chemical-specific ARARs for the organic and radionuclide contaminants in Trench 3. However, there are residual soil standards for radionuclides as a class (DOE Order 5400.5). Location-specific ARARs are regulations that set restrictions on activities or contaminant levels based on unique characteristics of the site. Examples of these are standards under the Wilderness Protection Act, the National Register of Historical Places, and the National Flood Insurance Program. There are also no promulgated Federal or State location-specific ARARs for the extraction action. Action-specific ARARs set controls or restrictions on particular kinds of activities related to management of hazardous substances or pollutants. The appropriate action-specific ARARs are listed specifically in Table 6-1.

Federal action-specific ARARs for this response action include: (1) RCRA standards for generators of hazardous waste and for container storage (42 U.S.C. Section 6901 et seq., and 40 CFR Parts 264 Subpart I (2) Atomic Energy Act (AEA) standards for protecting workers in the handling of radioactive material and standards for storage of radioactive material (42 U.S.C. Section 2201 and 10 CFR Parts 820 and 830), and (3) all applicable DOE Orders pursuant to the AEA.

State action-specific ARARs for the extraction include:

1) CHWA standards for hazardous waste generators and for container storage (CRS Section 25-15-101 to 25-15-313 and 6 CCR Section 1007-3 Parts 264). The CHWA regulations directly applicable to this action are similar to the federal RCRA standards (See Table 6-1); however, there are several indirectly applicable CHWA standards that are more stringent. These standards are for hazardous waste generators as well as for treatment, storage, and disposal (TSD) facilities. Because RFETS is a hazardous waste generator and TSD facility

Table 7-1 Action-Specific ARARs for Trench T-3 Liquids Removal OU2

Action	Requirement	Prerequisite	Citation	ARAR	Comments
Container Storage (Onsite)	If wastes are stored beyond 90 days in storage units, generator must comply with storage requirements in Subpart 264 (detailed below).	Storage of hazardous waste beyond 90 days for large quantity generators.	6 CCR 1007-3 CFR 262.34(b)[a]	A	
	Containers of hazardous waste must be: • Maintained in good condition; • Compatible with hazardous waste to be stored; and • Closed during storage (except to add or remove waste).	RCRA hazardous waste (listed or characteristic) held for a temporary period before treatment, disposal, or storage elsewhere, in a container (i.e., any portable device in which a material is stored, transported, disposed of, or handled) (6 CCR 1007-3 and 40 CFR 260.10).	6 CCR 1007-3 and 40 CFR 264.171[a] 6 CCR 1007-3 and 40 CFR 264.172 6 CCR 1007-3 and 40 CFR 264.173	A	RCRA container storage requirements are applicable because RFETS RCRA Unit 1 is a permitted storage unit.
	• Inspect container storage areas weekly for deterioration.		6 CCR 1007-3 40 CFR 264.174		
	• Keep incompatible materials separate. Separate incompatible materials stored near each other by a dike or other barrier.		6 CCR 1007-3 and 40 CFR 264.177		
	• RCRA hazardous waste generators must put the date storage begins and the words "Hazardous Waste" on the containers.		6 CCR 1007-3 and 40 CFR 262.34(a)	R&A	Since storage may be long term, date on container may not be applicable.
Treatment/ Disposal	• Prohibition of specific wastes from land disposal.	Disposal of waste must meet 40 CFR 268. (Land Disposal Restrictions)	40 CFR 268 Subpart C 6 CAR 1007-3	A	
	• Waste must meet treatment standards before disposal.		40 CFR 268 Subpart D 6 CAR 1007-3	A	
Storage	• Ensure protection of public health and safety. • External exposure to waste and concerns of radioactive material which may be released into surface water, groundwater, soil, plants and animals can only result in an effective dose equivalent not exceeding 25 mrem/yr to any member of the public. • Ensure that committed effective dose equivalents received by individuals who inadvertently intrude into facility after 100 years will not exceed 100 mrem/yr for continuous exposure or	DOE facilities must comply with DOE Orders pertaining to health and safety and protection of workers from radiation.	DOE Order 5820.2A Chapter III	A	

Table 7-1 Action-Specific ARARs for Trench T-3 Liquids Removal OU2

Action	Requirement	Prerequisite	Citation	ARAR	Comments
	500 mrem for a single acute exposure. • Protect groundwater resources. • Storage facility must be monitored for migration of radionuclides. Monitor surface soil and air. • Maintain records for all low-level waste that enters and leaves the storage facility. • Purpose of storage may be to allow nuclides to decay or to store wastes until disposal method becomes available.		DOE Order 5820.2A Chapter III	A	
Removal and Storage	• Comply with all applicable environmental protection, safety and health standards.	DOE facilities must comply with DOE Orders and promulgated DOE regulations in 10 CFR concerning environmental health and safety.	DOE Order 5480.4	A	
	• Comply with dose limits for protection of public and limits for residual radioactive material in environment.		DOE Order 5400.5	A	
	• Comply with generally applicable nuclear safety standards in this rule.				
	• Develop and implement quality assurance program.				
	• Occupational exposure to workers must be within acceptable limits and as far below the limits as is reasonably achievable. Comply with "Limiting Values" for radiation exposure.				
Removal	Personnel conducting storage and handling operations from which fugitive particulate emissions will be emitted must use all available practical methods to minimize the emissions. Personnel may use enclosures, cover, compacting, watering, limitation of fines, and other methods. There may be no off-property emissions.		Regulation 1, CO Air Quality Control Commission III.D.1 III.D.2.c		

Table 7-1 Action-Specific ARARs for Trench T-3 Liquids Removal OU2

Action	Requirement	Prerequisite	Citation	ARAR	Comments
	Residual concentrations of "Radionuclides" (general) should be derived from the basic dose limits (100 mrem effective dose equivalent in one year) by an environmental pathway analysis (See DOE/CH-8901).		DOE Order 5400.5 Chapter IV	A	

NOTE: DOE Order 5400.3, "Hazardous Waste and Radioactive Mixed Waste Program" was canceled as of August 1994.

[a] Colorado regulations pursuant to the Colorado Hazardous Waste Act for hazardous waste generators and container storage are similar to, but more stringent than, federal RCRA standards.

[b] This order (5700.6c) has been codified (10 CFR 830.120) in the April 15, 1994, Federal Register (59 FR 15843).

[c] This order (5480.11) has been codified (10 CFR) in the December 14, 1993, Federal Register (58 FR 65458).

A = Applicable

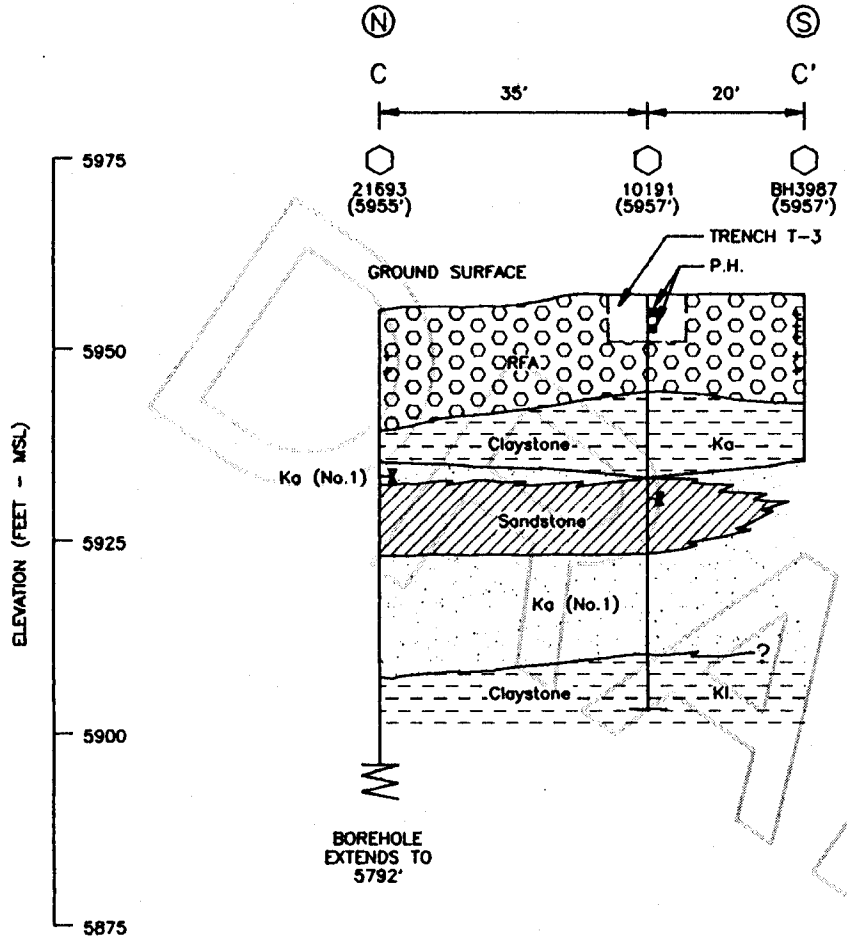
R&A = Relevant and Appropriate

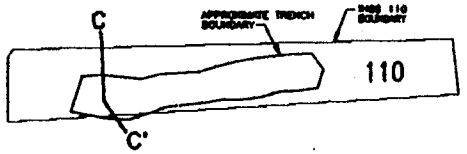
permitted with the State of Colorado, DOE is aware of, and compliant with, these more stringent CHWA regulations; and

2) Colorado Air Pollution Prevention and Control Act standards for air emissions (CRS Section 25-7-101 to 25-7-609 and 5 CCR Section 1001).

Colorado's Radiation Control Act applies to parties licensed or registered under the state program. Because DOE has its own licensing program, it is not licensed by the State of Colorado. Therefore, the Colorado Radiation Control Act is not applicable to this action, or RFETS.

Appendix A
Figures



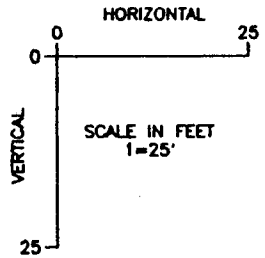


CROSS-SECTION LOCATION MAP

111.1

NOTES:

1. ONLY INITAL WATER LEVEL ENCOUNTERED WAS RECORDED ON BOREHOLE LOG FOR 1993 WELLS.
2. HIGH WATER LEVELS COULD NOT BE DETERMINED BECAUSE INSTALLED AS WELLS.



EXPLANATION

- MONITORING WELL SCREEN INTERVAL
- TOTAL DEPTH OF BOREHOLE
- INITIAL WATER LEVEL IN BOREHOLE DURING DRILLING
- HIGH WATER LEVEL (SECOND QUARTER 1992)
- LOW WATER LEVEL (FOURTH QUARTER 1993)
- + TRACE TO SOME CALICHE IN MATRIX
- P.H. ■ P.H. PETROLEUM HYDROCARBONS IN SAMPLE MATRIX
- LOCATION SYMBOL
- 10191 (5958) LOCATION NUMBER / LOCATION ELEVATION (ft)
- BOREHOLE LOCATION
- ALLUVIAL MONITORING WELL LOCATION
- BEDROCK MONITORING WELL LOCATION
- RFA ROCKY FLATS ALLUVIUM
- CALICHE
- CLAYSTONE Ka - ARAPAHOE FORMATION Kl - LARAMIE FORMATION
- Ka (No.1) ARAPAHOE FORMATION NO.1 SANDSTONE
- HIGH POROSITY, HIGHLY FRIABLE SANDSTONE LAYER OF THE ARAPAHOE NO. 1 SANDSTONE

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Golden, Colorado

OPERABLE UNIT 2
SUBSURFACE IM/IRA SITE 1
TECHNICAL MEMORANDUM NO. 4

C-C' CROSS-SECTION
BENEATH TRENCH T-3
(IHSS 110)

FIGURE 2 FEBRUARY 1995

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Appendix B

Summary of November and December 1994 Characterization

TRENCH T-3 (IHSS110)
DRILLING AND SOIL SAMPLE COLLECTION AND ANALYSIS SUMMARY
November 1994

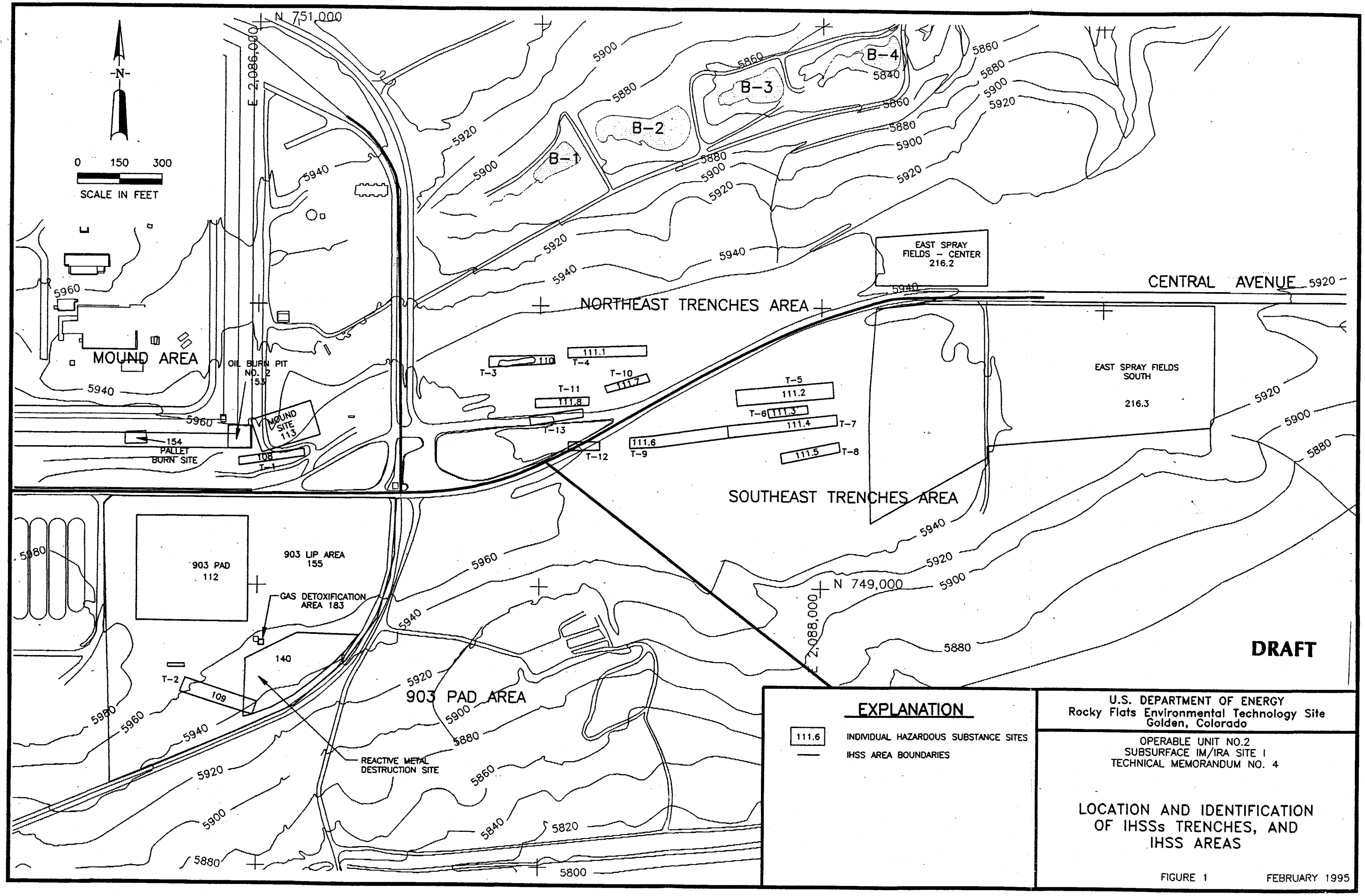
Location Number	Location Type	Start Date	End Date	Total Depth (ft)(BGS)	Top of Bedrock	RFEDS Sample Number	Waste Sample Number	Sample Start Depth (ft)BGS)	Sample End Depth (ft)(BGS)	Analysis Requested	Comment
25194	BH/EW	11/2/94	11/10/94	5.3	NE	BH20665WC	95N0058	3.6	5.3	VBR, BDR, WW, RH	Liquid Sample
						DR00010WC		0	4	RH, V, B, M, RA, RB, RC	Drum Composite
						DR00016WC		0	4	RH, V, B, M, RA, RB, RC	Drum Composite
25294	BH	11/2/94	11/4/94	8	NE	BH20654WC		6.75	7	RH, VBR	Discrete VOA
						BH20655WC		6	8	RH, BDR	Compositee
						DR00011WC		0	8	RH, V, B, M, RA, RB, RC	Drum Composite
25394	BH	11/4/94	11/4/94	9	NE	BH20651WC		4	6	RH, WH, VBR	Compositee
						BH20650WC		5.75	6	RH, VBR	Discrete VOA
						BH20653WC		6	8	RH, GQB	Composite
						DR00012WC		0	8	RH, V, B, M, RA, RB, RC	Drum Composite
25494	BH	11/7/94	11/7/94	3.5	NE	DR00013WC		0	3.5	RH, V, B, M, RA, RB, RC	Drum Composite
25594	BH	11/7/94	11/8/94	16	15.5	BH20658WC		15.75	16	RH, VBR	Discrete VOA
						BH20659WC		9	10	RH, BDR, WW	Composite
						BH20660WC		9.8	10	RH, VBR	Discrete VOA
						DR00014WC		0	16	RH, V, B, M, RA, RB, RC	Drum Composite
25694	BH	11/8/94	11/9/94	14	NE	BH20652WC		10	12	RH, GQB	Composite
						BH20656WC		11.8	12	RH, VBR	Discrete VOA
						BH20657WC		4	6	RH, GQB	Composite
						DR00015WC		0	14	RH, V, B, M, RA, RB, RC	Drum Composite

Explanations:

BH - Borehole
EW - Extraction well
NE -Not encountered
BGS - Below ground surface
RH - Radionuclide screen
RA - Gross alpha and beta
RB - Plutonium-239/240, Americium-241
RC - Uranium-233,234, Uranium-235, Uranium-238
V - VOA-CLP
VBR - VOA (8240)
B - BNA-CLP
BDR - BNA (8270)
M - Total Metals-CLP
GQB - Soil moisture content
WH - Total organic carbon
WW - Total petroleum hydrocarbons (8015 modified)

Appendix C
Acronym List

AEA	Atomic Energy Act
ARAR	Applicable or Relevant and Appropriate Requirements
CCI_4	Carbontetrachloride
CHC	Chlorinated Hydrocarbons
CHCI	Chloroform
CHWA	Colorado Hazardous Waste Act
DCA	Dichloroethane
DOE	Department of Energy
DSSI	Diversified Scientific Services, Inc.
EPA	Environmental Protection Agency
FTU	Field Treatment Unit
IAG	Interagency Agreement
IHSS	Individual Hazardous Substance Site
NAPL	Non-Aqueous Phase Liquid
NEPA	National Environmental Policy Act
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PAH	Polynuclear Aromatic Hydrocarbons
PAM	Proposed Action Memorandum
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethylene
PPE	Personal Protective Equipment
Pu	Plutonium
RCRA	Resource Conservation and Recovery Act
RFA	Rocky Flats Alluvium
RFETS	Rocky Flats Environmental Technology Site
SVOC	Semivolatile Organic Compound
TBC	To Be Considered
TCA	Trichloroethane
TCE	Trichloroethylene
TSD	Treatment, Storage, and Disposal
U	Uranium
UHSU	Upper Hydrostratigraphic Unit
VOC	Volatile Organic Compound
WAC	Waste Acceptance Criteria



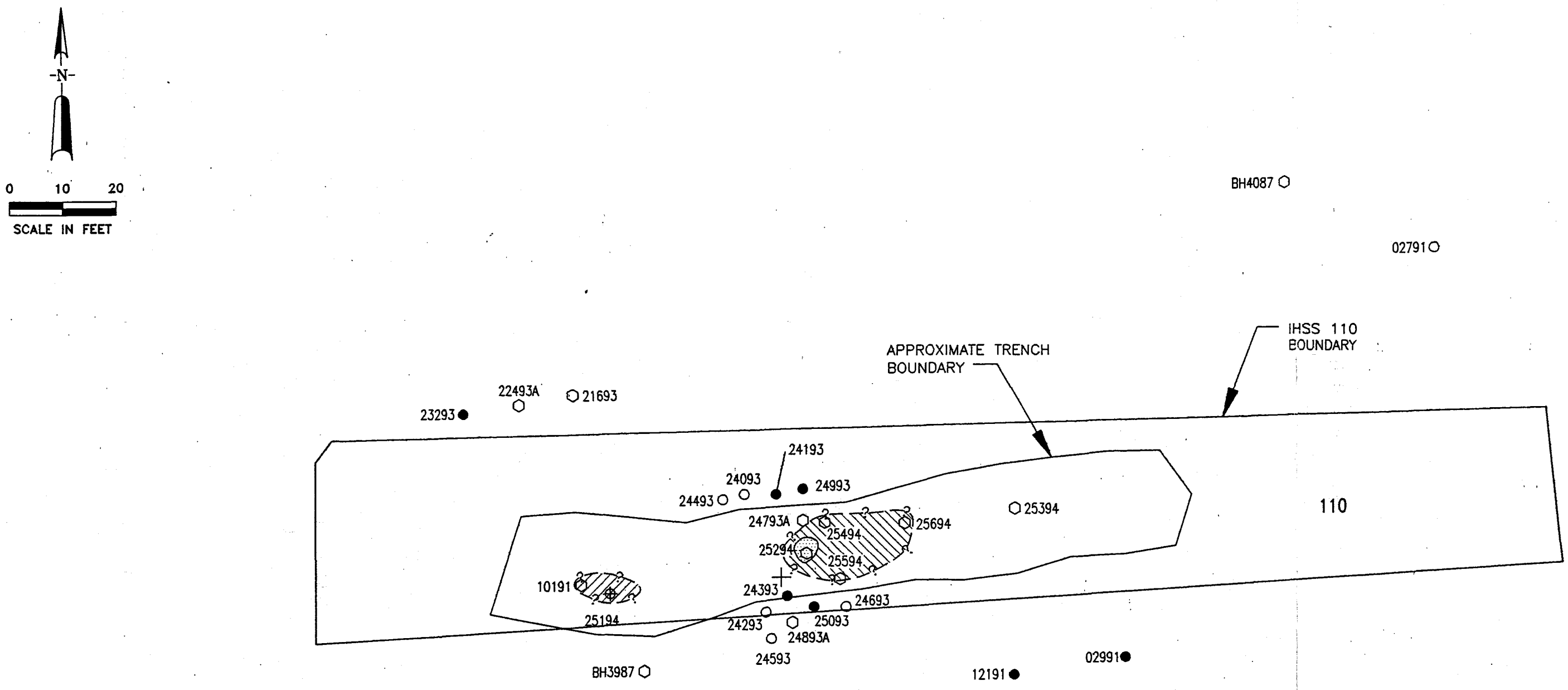
U.S. DEPARTMENT OF ENERGY
Rocky Flats Environmental Technology Site
Golden, Colorado

OPERABLE UNIT NO.2
SUBSURFACE IM/IRA SITE I
TECHNICAL MEMORANDUM NO. 4

LOCATION AND IDENTIFICATION OF IHSSs TRENCHES, AND IHSS AREAS

FIGURE 1 FEBRUARY 1995

SVETM071 1=300



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EXPLANATION

- APPROXIMATE AREAL EXTENT OF FLATTENED DRUMS
- APPROXIMATE AREAL EXTENT OF VOID SPACE
- APPROXIMATE AREAL EXTENT OF NAPL OR LIQUID
- 10191 ⬡ SOURCE BOREHOLE LOCATION
- 2487 ○ ALLUVIAL MONITORING WELL LOCATION
- 12191 ● BEDROCK MONITORING WELL LOCATION
- 22493A ⬡ ABANDONED MONITORING WELL LOCATION
- 25194 ⊕ EXTRACTION WELL LOCATION
- 110 INDIVIDUAL HAZARDOUS SUBSTANCE SITE LOCATION

U.S. DEPARTMENT OF ENERGY
Rocky Flats Environmental Technology Site
Golden, Colorado

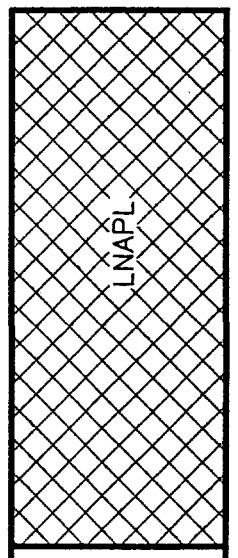
OPERABLE UNIT 2
SUBSURFACE IM/IRA SITE 1
TECHNICAL MEMORANDUM NO. 4

AREAL EXTENT OF VOID SPACE, FLATTENED DRUMS, AND NAPL OR LIQUID IN TRENCH T-3

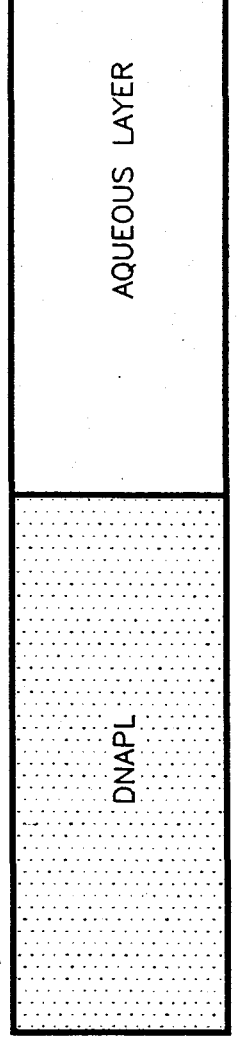
Figure 3

FEBRUARY 1995

SVETM066 1=20



AQUEOUS LAYER



FLOATING LAYER (LNAPL)

DETECTED VOC ANALYTE	CONCENTRATION (ug/kg)(1)	DETECTED SVOC ANALYTE	CONCENTRATION (ug/kg)(1)	DETECTED TPH ANALYTE	CONCENTRATION (mg/kg)(1)	RADIONUCLIDE SCREEN ANALYTE(2)	AVTIVITY (pCi/L)
ACETONE	3,100	2-METHYLPHENOL	20,000	GASOLINE(3)	170,000	GROSS BETA	803,000
1,1-DCE	260	4-METHYLPHENOL	74,000	DIESEL(4)	370,000	GROSS ALPHA	749,000
METHYLENE CHLORIDE	310	NAPHTHALENE	220,000				
1,1-DCA	1,100	2-METHYLNAPHTHALENE	450,000				
$CHCl_3$	5,500	N-NITROSODIPHENYLAMINE	380,000				
1,1,1-TCA	18,000	PHENANTHRENE	200,000				
TCE	7,100,000E	ANTHRACENE	190,000				
TOLUENE	1,200	DI-N-BUTYLPHTHALATE	120,000				
PCE	37,000,000E	BIS(2-ETHYLHEXYL)PHTHALATE	310,000				
ETHYLBENZENE	920						
M,P-XYLENE	8,200						
O-XYLENE	2,200						

AQUEOUS LAYER

DETECTED VOC ANALYTE	CONCENTRATION (ug/L)	DETECTED SVOC ANALYTE	CONCENTRATION (ug/L)	DETECTED TPH ANALYTE	CONCENTRATION (mg/L)	RADIONUCLIDE SCREEN ANALYTE(2)	ACTIVITY (pCi/L)
ACETONE	52,000	2-METHYLPHENOL	14,000E	GASOLINE(3)	1,900	GROSS BETA	803,000
METHYLENE CHLORIDE	57	4-METHYLPHENOL	9,500E	DIESEL(4)	3,700	GROSS ALPHA	749,000
1,1-DCA	92	2-METHYLNAPHTHALENE	100				
2-BUTANONE	650	PHENANTHRENE	530				
$CHCl_3$	420	DI-N-BUTYLPHTHALATE	620				
1,1,1-TCA	420	BIS(2-ETHYLHEXYL)PHTHALATE	870				
TCE	97,000						
PCE	650,000						
ETHYLBENZENE	24						
M,P-XYLENE	240						
O-XYLENE	84						

SINKING LAYER (DNAPL)

DNAPL LAYER DISSOLVED DURING SHIPMENT TO LABORATORY

(1) DUE TO ELEVATED CONCENTRATIONS, RESULTS WERE REPORTED IN MASS UNITS (ie.,ug/kg) INSTEAD OF LIQUID UNITS (ie., ug/L).

(2) ONE RADIONUCLIDE SCREEN WAS PERFORMED PRIOR TO SHIPMENT ON THE FLOATING OIL AND WATER LAYERS.

(3) GASOLINE RANGE ORGANICS (C_6 THROUGH C_{12}).

(4) DIESEL RANGE ORGANICS (C_{12} THROUGH C_{24}).

EXPLANATION

ug/kg = MICROGRAM PER KILOGRAM (PARTS PER BILLION)
mg/kg = MILLIGRAM PER KILOGRAM (PARTS PER MILLION)
ug/L = MICROGRAM PER LITER (PARTS PER BILLION)
mg/L = MICROGRAM PER LITER (PARTS PER MILLION)
pCi/L = PICOCURIE PER LITER
LNAPL = LIGHT NON-AQUEOUS PHASE LIQUID
DNAPL = DENSE NON-AQUEOUS PHASE LIQUID
VOC = VOLATILE ORGANIC COMPOUND
SVOC = SEMI-VOLATILE ORGANIC COMPOUND
TPH = TOTAL PETROLEUM HYDROCARBON

NOTE:
ANALYTE ABBREVIATIONS ARE PRESENTED ON FIGURE 2.6-1

DRAFT

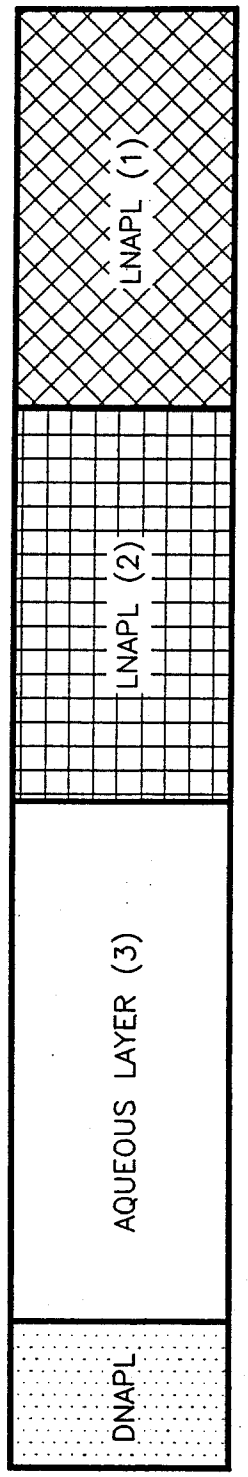
U.S. DEPARTMENT OF ENERGY
Rocky Flats Environmental Technology Site
Golden, Colorado

OPERABLE UNIT 2
SUBSURFACE IM/IRA SITE 1
TECHNICAL MEMORANDUM NO. 4

SUMMARY OF ANALYTICAL RESULTS FOR LIQUIDS COLLECTED FROM BOREHOLE 25194 IN NOVEMBER 1994

FEBRUARY 1995

SVETM068 1=1



FLOATING LAYER (1) (LNAPL 1)

DETECTED VOC ANALYTE	CONCENTRATION (ug/kg)(4)	DETECTED SVOC ANALYTE	CONCENTRATION (ug/L)	DETECTED TPH ANALYTE	CONCENTRATION (mg/L)	RADIONUCLIDE SCREEN ANALYTE	ACTIVITY (pCi/L)	SELECTED RADIONUCLIDE	ACTIVITY (pCi/g)	SAMPLE NUMBER
TCE PCE	330,000 2,800,000	NAPHTHALENE 2-METHYLNAPHTHALENE PHENANTHRENE DI-N-BUTYLPHTHALATE PYRENE CHRYSENE BIS(2-ETHYLHEXYL)PHTHALATE	2,700 4,700 6,900 4,400 280 280 20,000	GASOLINE(6) DIESEL(7)	3,100 4,000	GROSS BETA GROSS ALPHA	42,000 19,400	Am-241 Pu-239/240 U-233/234 U-235 U-238	NA NA NA NA NA	C0639

FLOATING LAYER (2) (LNAPL 2)

DETECTED VOC ANALYTE	CONCENTRATION (ug/kg)(4)	DETECTED SVOC ANALYTE	CONCENTRATION (ug/kg)(4)	DETECTED TPH ANALYTE	CONCENTRATION (mg/kg)(4)	RADIONUCLIDE SCREEN ANALYTE(5)	ACTIVITY (pCi/L)	SELECTED RADIONUCLIDE	ACTIVITY (pCi/g)	SAMPLE NUMBER
TCE PCE	330,000 2,800,000	NAPHTHALENE 2-METHYLNAPHTHALENE FLUORENE PHENANTHRENE DI-N-BUTYLPHTHALATE BIS(2-ETHYLHEXYL)PHTHALATE	110,000 380,000 26,000 140,000 85,000 370,000	GASOLINE(6) DIESEL(7)	170,000 480,000	GROSS BETA GROSS ALPHA	39,400 22,600	Am-241 Pu-239/240 U-233/234 U-235 U-238	0.008 0.029 1.96 0.35 15.5	C0640

AQUEOUS LAYER

DETECTED VOC ANALYTE	CONCENTRATION (ug/kg)(4)	DETECTED SVOC ANALYTE	CONCENTRATION (ug/L)	DETECTED TPH ANALYTE	CONCENTRATION (mg/L)	RADIONUCLIDE SCREEN ANALYTE(5)	ACTIVITY (pCi/L)	SELECTED RADIONUCLIDE	ACTIVITY (pCi/g)	SAMPLE NUMBER
TCE PCE	330,000 2,700,000	PHENOL 2-METHYLPHENOL 4-METHYLPHENOL 2,4-DIMETHYLPHENOL NAPHTHALENE 2-METHYLNAPHTHALENE FLUORENE PHENANTHRENE DI-N-BUTYLPHTHALATE CHRYSENE BIS(2-ETHYLHEXYL)PHTHALATE	1,000 3,400 26,000 2,600 1,000 3,400 420 2,300 1,400 110 7,500	GASOLINE(6) DIESEL(7)	1,700 2,500	GROSS BETA GROSS ALPHA	39,400 22,600	Am-241 Pu-239/240 U-233/234 U-235 U-238	1.62 1.16 398.0 101.0 3,240.0	C0670

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SINKING LAYER (DNAPL)

NO SAMPLE WAS COLLECTED IN FIELD

(1) FLOATING LAYER SEPARATED DURING SAMPLING (SAMPLE NUMBER C0639)

(2) FLOATING LAYER SEPARATED AT LABORATORY (SAMPLE NUMBER C0640)

(3) AQUEOUS LAYER SEPARATED AT LABORATORY (SAMPLE NUMBER C0670)

(4) DUE TO ELEVATED CONCENTRATIONS, RESULTS WERE REPORTED IN MASS UNITS (ie., ug/kg) INSTEAD OF LIQUID UNITS (ie., ug/L).

(5) ONE RADIONUCLIDE SCREEN WAS PERFORMED PRIOR TO SHIPMENT ON THE FLOATING(2) AND AQUEOUS LAYERS.

(6) GASOLINE RANGE ORGANICS (C_6 THROUGH C_{12}).

(7) DIESEL RANGE ORGANICS (C_{12} THROUGH C_{24}).

EXPLANATION

ug/kg = MICROGRAM PER KILOGRAM (PARTS PER BILLION)
mg/kg = MILLIGRAM PER KILOGRAM (PARTS PER MILLION)
ug/L = MICROGRAM PER LITER (PARTS PER BILLION)
mg/L = MICROGRAM PER LITER (PARTS PER MILLION)
pCi/L = PICOCURIC PER LITER
pCi/g = PICOCURIC PER GRAM
LNAPL = LIGHT NON-AQUEOUS PHASE LIQUID
DNAPL = DENSE NON-AQUEOUS PHASE LIQUID
VOC = VOLATILE ORGANIC COMPOUND
SVOC = SEMI-VOLATILE ORGANIC COMPOUND
TPH = TOTAL PETROLEUM HYDROCARBON
NA = NOT AVAILABLE

NOTE:
ANALYTE ABBREVIATIONS ARE PRESENTED ON FIGURE 2.6-1.

U.S. DEPARTMENT OF ENERGY
Rocky Flats Environmental Technology Site
Golden, Colorado

OPERABLE UNIT 2
SUBSURFACE IM/IRA SITE 1
TECHNICAL MEMORANDUM NO. 4

SUMMARY OF ANALYTICAL RESULTS FOR LIQUID COLLECTED FROM EXTRACTION WELL 25194 IN DECEMBER 1994

FEBRUARY 1995

SVETM069 1=1